



Limits to the predictability of volcanic eruptions based on accelerating rates of seismicity

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Volcanic eruptions are commonly preceded by elevated rates of seismicity. Various models have been proposed to explain trends in pre-eruptive earthquake rate and potentially promise quantitative forecasts of the timing of future eruptions. However, these models, and their forecasting power, remain largely untested. Here we use simulations to define limits to the predictability of eruptions based on accelerating rates of seismicity. We first compare the performance of different modeling methodologies for the retrospective analysis of data (where the eruption time is known). We then apply these methodologies in pseudo-prospective mode (where the eruption time is unknown), considering the effect of different forms of prior distributions of parameter values. Our results demonstrate the large inherent uncertainty in eruption forecasts even in these ideal scenarios, and highlight the necessity for: (1) greater experimental and theoretical constraint on model parameters; and (2) the need for truly prospective testing of forecast performance.